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ABSTRACT

Recent emphasis on raising standards has attracted Americans' attention to factors that improve student learning. An examination of the relationship between teacher knowledge and student performance is offered in this report. The text summarizes what research suggests about various kinds of teacher education, the professional development teachers need in order to learn how to teach to high standards, and the relationship between teacher knowledge and student achievement and what matters for teacher effectiveness. It details what states are doing to provide these opportunities for teacher learning and with what effects. The narrative focuses on problems in the preparation of U.S. teachers and provides international comparisons of teacher development. It discusses whether other countries are able to support teaching more effectively than the U.S., and it reports some of the recommendations of the National Commission on Teaching and America's Future. Some examples of effective professional development programs are described along with some promising state strategies for improving teaching, such as standards-based reforms of teaching. It is suggested that professional discourse develop around problems of practice and that learning from the analysis of practice be emphasized in teacher education. (RJM)

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Teaching for High Standards: What Policymakers Need to Know and Be Able to Do

Linda Darling-Hammond
Deborah Loewenberg Ball

National Commission on Teaching & America's Future

CPRE
CONSORTIUM FOR POLICY RESEARCH IN EDUCATION

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About NCTAF

The National Commission on Teaching & America's Future (NCTAF) was launched on November 15, 1994 to evaluate what changes in education would be needed to ensure that every child in every community has access to the kind of teaching needed to help him or her meet today's new high standards. Chaired by Governor James B. Hunt Jr. of North Carolina and directed by Linda Darling-Hammond, professor at Teachers College, Columbia University, the Commission is a bipartisan blue-ribbon group of 26 public officials, business and community leaders, and educators representing major stakeholders in education. The Commission's report, *What Matters Most: Teaching for America's Future*, was released in September 1996. Its recommendations addressed the preparation, recruitment, licensure, certification, induction, professional development, and continuing support of teachers and principals. Commission staff are currently working with a network of 12 states and a growing number of urban school districts working together to implement Commission recommendations. The Commission's partner states are: Georgia, Illinois, Indiana, Kansas, Kentucky, Maine, Maryland, Missouri, Montana, North Carolina, Ohio, and Oklahoma.

The Commission is supported by grants from the Rockefeller Foundation; Carnegie Corporation of New York; the BellSouth Foundation; the DeWitt Wallace-Reader's Digest Fund; the Ford Foundation; the Philip Morris Companies Inc.; and the U.S. Department of Education's Office of Educational Research and Improvement, through the National Institute on Educational Governance, Finance, Policymaking, and Management, the National Partnership for Excellence and Accountability in Teaching, and the Center for the Study of Teaching and Policy.

Teaching for High Standards: What Policymakers Need to Know and Be Able to Do

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Deborah Loewenberg Ball is professor of education at the University of Michigan. With elementary school mathematics as the main context, her research focuses on the challenges of teaching for understanding and on efforts to support such teaching through policy, reform initiatives, and teacher education. Her publications include articles on teacher learning and teacher education; the role of subject matter knowledge in teaching and learning to teach; challenges embedded in trying to teach for understanding; and relations of policy and practice in instructional reform.

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Introduction

Recent emphasis on raising standards has attracted Americans' attention to what factors make a difference in student learning. The September, 1996 report of the National Commission on Teaching and America's Future (the Commission), *What Matters Most: Teaching for America's Future*, followed by *Pursuing Excellence*, the report of the Third International Mathematics and Science Study, sharpened this discussion by pointing to the close relationship between student achievement and teachers' skills, knowledge, and practices. According to these reports, *what teachers know and can do is crucial to what students learn*. From this conclusion, three important policy implications follow:

- The recruitment and retention of good teachers is key to improving our schools.
- A strong teaching force depends on serious attention to teachers' preparation and ongoing learning.
- School reform cannot succeed unless it focuses on creating the conditions—including school and curriculum contexts—in which teachers can teach well.

In this report, we discuss the relationship between teacher knowledge and student performance; we summarize what the research suggests about the kinds of teacher education and professional development teachers need in order to learn how to teach to high standards; and we describe what states are doing to provide these opportunities for teacher learning, and with what effects.

The Relationship Between Teacher Knowledge and Student Achievement

For many decades the United States education system has tried to improve student achievement by tinkering with various levers in the great machinery of schooling. New management schemes, curriculum packages, testing policies, centralization initiatives, decentralization initiatives, and a wide array of regulations and special programs have been tried, all with the same effect. Reforms, we have learned over and over again, are rendered effective or ineffective by the knowledge, skills, and commitment of those working in the schools. Without know-how and buy-in, innovations do not succeed. Neither can they succeed without appropriate supports, including time, materials, and opportunities to learn.

Furthermore, studies discover again and again that teacher expertise is one of the most important factors in determining student achievement, followed by the smaller but generally positive influences of small schools and small class sizes, especially in the early grades. In other words, teachers who know a lot about teaching and learning and who work in settings that allow them to know their students well are the critical elements of successful learning.

How Does Teachers' Expertise Affect Student Learning?

Teacher expertise—what teachers know and can do—affects all the core tasks of teaching. What teachers understand about content and students, for example, shapes how judiciously they select from texts and other materials and how effectively they present material in class. Teachers' skill in assessing their students' progress also depends on how deeply teachers know the content, and how well they understand and interpret student talk and

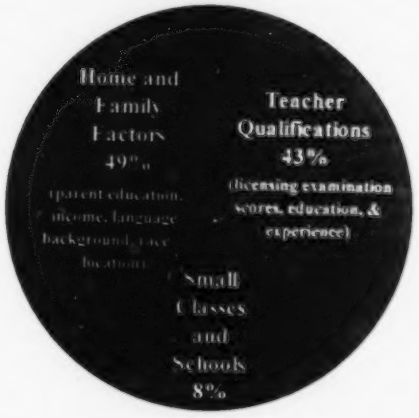
written work. Nothing can fully compensate for the weakness of a teacher who lacks the knowledge and skill needed to help students master the curriculum.

Measures of teachers' education, certification, knowledge, and experience have been measures of teacher expertise in large-scale data sets.[1] In an analysis of the most extensive data base since the 1966 Coleman study, Ronald Ferguson found that teacher expertise (as measured by teacher education, licensing examination scores, and experience) accounted for more variation in student achievement than any other factor (about 40 percent of the total), and that every additional dollar spent on more highly qualified teachers netted greater increases in student achievement than did other less instructionally-focused uses of school resources.[2] The effects were so strong, and the variations in teacher expertise were so great, that, after controlling the socioeconomic status, the large disparities in achievement between black and white students were almost entirely explained by differences in their teachers' qualifications. An additional contribution to student achievement in the elementary grades was made by lower pupil-teacher ratios. In combination, well-prepared teachers working in personalized environments contributed as much to student outcomes as socioeconomic factors. (See Figure 1.)

Ferguson's findings closely mirror those of a 1996 review of 60 studies by Greenwald, Hedges, and Laine[3], which found that teacher education, ability, and experience, along with small schools and lower teacher-pupil ratios, are associated with significant increases in student achievement. The authors estimate of the achievement gains associated with various uses of funds that spending more on teacher education was the most productive investment for schools. (See Figure 2.)

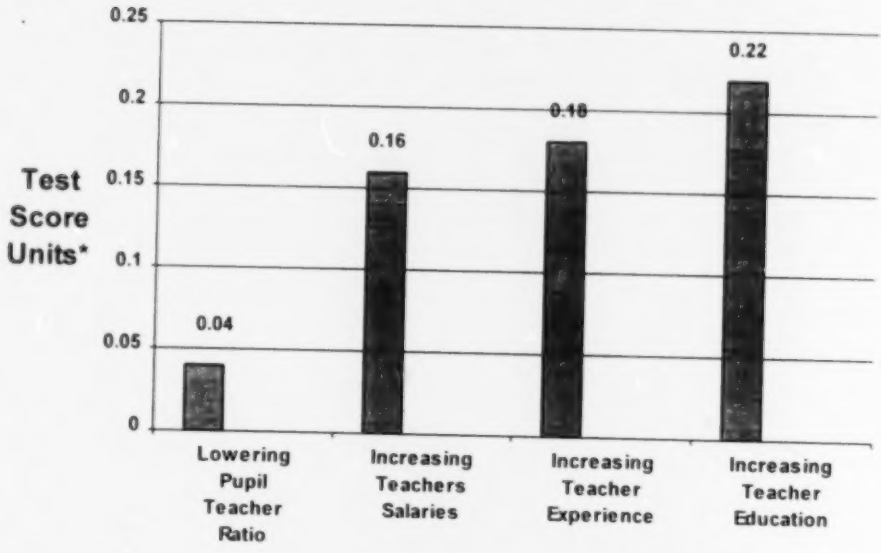
Figure 1. Influence of Teacher Qualifications on Student Achievement

Proportions of Explained Variance of Factors Affecting Math Test Score Gains (Grades 3 to 6)


Home and Family Factors 49%
(parent education, income, language background, race/ location)
Teacher Qualifications 43%
(licensing examination scores, education, & experience)
Small Classes and Schools 8%

Source: Ferguson, R. F. (1991). Paying for public education: New evidence of how and why money matters. *Harvard Journal on Legislation*, 28, 465-498.

Figure 2. Size of Increase in Student Achievement for Every $500 Spent on:



*Achievement gains were calculated as standard deviation units on a range of achievement tests used in the 60 studies reviewed.

Greenwald, R., L.V. Hedges, & R.D. Laine (1996). The Effect of School Resources on Student Achievement. *Review of Educational Research 66*(3), pp. 361-396.

Other studies have come to similar conclusions. A study of high- and low-achieving schools with similar student populations in New York City found that differences in teacher qualifications accounted for about 90 percent of the variation in student achievement in reading and mathematics at all grade levels tested.[4] A Tennessee study of the effects of teachers on student learning found that elementary school students who are assigned to ineffective teachers for three consecutive years score significantly lower on achievement tests than those assigned to the most effective teachers over the same period of time.[5] Furthermore, black students are far more likely to be assigned to the least effective teachers and far less likely to be assigned to the most effective ones. (See Figure 3.)

What Matters for Teacher Effectiveness?

Another body of research confirms that teacher knowledge of subject matter, student learning and development, and teaching methods are all important elements of teacher effectiveness. Reviews of several hundred studies contradict the long-standing myths that "anyone can teach" and that "teachers are born and not made." Teacher education, as it turns out, matters a great deal. In fields ranging from mathematics and science to early childhood, elementary, vocational, and gifted education, teachers who are fully prepared and certified in both their discipline and in education are more highly rated and are more successful with students than are teachers without

preparation, and those with greater training are found to be more effective than those with less.[6]

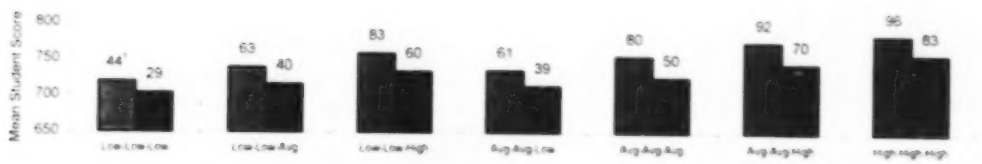
A review of 65 studies of science teaching concluded that teachers' effectiveness in teaching science depends on the amount and kind of teacher education and disciplinary training they have had and on the professional development opportunities they experience later in their careers.[7] Another review found that the extent of teachers' preparation in mathematics methods, curriculum, and teaching is as important in predicting effectiveness as is preparation in mathematics content.[8] Finally, students who study with fully certified mathematics teachers experience significantly greater gains in achievement than those who are taught by unlicensed or out-of-field teachers.[9]

The National Assessment of Educational Progress has documented that teachers' qualifications are among the correlates of student reading achievement: students of fully certified teachers and of teachers with higher levels of education do better. Furthermore, these teachers are more likely to have had professional coursework that enables them to use the literature-based and writing-based approaches to teaching reading and writing that stimulate the higher-level performance skills associated with stronger achievement (See Table 1).

Teachers who have spent more time studying teaching are more effective overall, and strikingly so in developing higher-order thinking skills and in meeting the needs of diverse students.[10] Teacher education does matter, and more teacher education appears to be better than less. As we describe below, recent studies of redesigned teacher education programs found that the graduates of five- or six-year programs that include an extended internship tied to coursework are more successful and more likely to enter and remain in teaching than graduates of traditional undergraduate programs.[11]

Figure 3. Cumulative Effects of Teacher Effectiveness

(Student test scores [5th grade math] by effectiveness level of their teachers over a three-year period for two metropolitan school systems)



* Denotes the corresponding percentile (CTB/McGraw-Hill, 1990, pp. 104-115)

Source: W.L. Sanders and J.C. Rivers, *Cumulative and Residual Effects of Teachers on Future Student Academic Achievement*, Knoxville: University of Tennessee, 1996

Problems in the Preparation of U.S. Teachers

Despite the critical importance of teacher knowledge, the United States offers fewer supports for teacher learning than do industrialized countries ranking higher on educational outcome measures. In addition, large numbers of U.S. teachers are not adequately prepared for their work. The National Commission on Teaching found that:

- In recent years, close to 50,000 people have entered teaching annually on emergency or substandard licenses. This represented about 1/4 of newly hired teachers in 1991.[12]

- More than one-fifth (21%) of all secondary teachers do not have even a minor in their main teaching field. This is true for more than 28% of mathematics teachers and 18% of science teachers.[13]

- Forty-eight percent of high school students taking physical science are taught by out-of-field teachers.[14] The proportions of students taught by out-of-field teachers are much higher in lower track classes, in high-poverty schools, and high-minority schools.

- In schools with the highest minority enrollments, students have less than a 50% chance of getting a science or mathematics teacher who holds a license and a degree in the field they teach.[15]

Problems in the preparation and licensing of teachers are reflected in the performance of U.S. students on international assessments. The U.S. has experienced chronic shortages of mathematics and physical science teachers for more than 40 years, and has typically met these problems by lowering standards instead of increasing the incentives to teach. More than 28 percent of U.S. mathematics teachers were teaching out-of-field in 1994, and only 53 percent of U.S. math teachers had both a license and a major in their field (See Figure 4.) If U.S. students are more likely to have teachers who are unprepared in mathematics, it should be no surprise that U.S. students compare least favorably with their international peers in mathematics, with eighth graders ranking 19th of 25 countries that met the Third International Mathematics and Science Study (TIMSS) guidelines (See Table 2). The picture is still worse by the end of American public schooling: at the twelfth grade level, U.S. students rank near the bottom in mathematics, with only students from Cyprus and South Africa scoring below the United States.

U.S. students tend to do better in the sciences than in mathematics, with eighth graders ranking 12th of 25 countries that met the TIMSS guidelines. But, as in mathematics, U.S. student achievement is poorer at the twelfth grade level, ranking 16th out of 21 countries. These achievement trends also mirror patterns of teacher qualifications. Only 18 percent of all teachers teaching general science are out-of-field. But 48 percent of U.S. high school students taking a physical science course are taught by out-of-field teachers because physical science teacher shortages are more severe than they are in other science fields. And in physical science, U.S. eighth graders rank 17th of 25 countries as compared to their international peers.

In contrast, U.S. students have compared favorably with students from other countries in reading, ranking at or above the median in fourth and eighth grades. This is partly due to the large investments in preparing teacher to teach reading at the elementary level—both reading specialists and regular classroom teachers. There is relatively little hiring of unqualified teachers in these fields. Most districts and schools provide substantial expert reading support to teachers and students.

Table 1
Correlates of Reading Achievement, Grade 4
National Assessment of Education Progress, 1992

Average Proficiency Scores (Percent of students)

Correlates of Reading Achievement	Lower Scores		Higher Scores
Teacher Qualifications			
Level of Certification	None, provisional or emergency (7%) 214	Regular, not highest level (37%) 216	Highest level (57%) 219
Level of Education	Bachelor's (54%) 215		Master's (45%) 220
Coursework in literature-based instruction	No coursework (16%) 214		Yes coursework (84%) 218
Coursework in whole language approaches	No coursework (20%) 214		Yes coursework (80%) 218
Coursework in phonics	Yes coursework (44%) 214		No coursework (56%) 220
Coursework in study strategies	No coursework (33%) 216		Yes coursework (67%) 218
Coursework in motivational strategies	No coursework (14%) 215		Yes coursework (86%) 218
Teaching Practices			
Ability Grouping	Students grouped by ability (34%) 212		Students not grouped by ability (66%) 220
Types of Materials	Primarily basal readers (33%) 214	Basal and trade books (51%) 218	Primarily trade books (13%) 224
Instructional Approaches	Structured Subskills (5%) 200	Literature-based (31%) 219	Integrative language (43%) 220
Instructional Emphasis on Integrated Reading and Writing	Little/no emphasis (3%) 211	Moderate emphasis (42%) 215	Heavy emphasis (55%) 220
Emphasis on Literature-based reading	Little/no emphasis (11%) 208	Moderate emphasis (38%) 217	Heavy emphasis (50%) 220
Amount of time devoted to decoding skills	Almost all the time (15%) 207	Some of the time (69%) 218	Rarely (15%) 221
Frequency with which students read aloud	Almost every day (47%) 213	At least weekly (45%) 221	Less than weekly (8%) 224
Amount of time devoted to oral reading	Almost all the time (24%) 211	Some of the time (70%) 219	Rarely/never (7%) 226

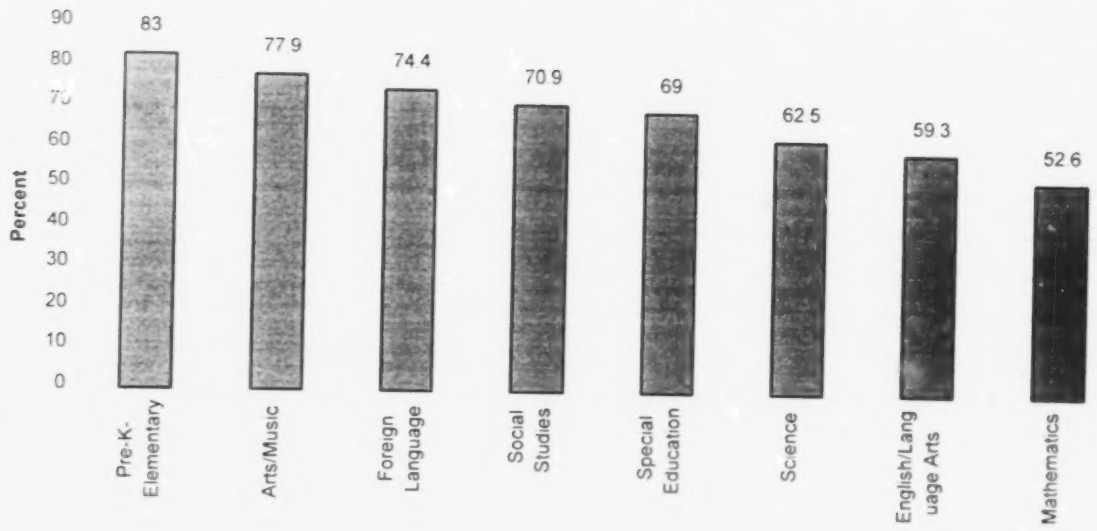
Table 1 (continued)
Correlates of Reading Achievement, Grade 4
National Assessment of Education Progress, 1992

Average Proficiency Scores (Percent of students)

Frequency with which students read silently	Less than weekly (2%) 208	At least weekly (23%) 213	Almost every day (75%) 219
Amount of time devoted to comprehension and interpretation	Rarely/never (0%)	Some of the time (30%) 216	Almost all the time (70%) 218
Frequency of use of reading workbooks and worksheets	Almost every day (31%) 214	At least once a week (48%) 217	Less than weekly (22%) 222
Frequency of group activities or projects about what students read	Less than weekly (76%) 217	At least once a week (21%) 219	Almost every day (3%) 221
Frequency with which students write about what they have read	Less than weekly (26%) 214	At least once a week (49%) 217	Almost every day (25%) 221
Frequency with which teachers use reading kits to teach reading	At least once a week (22%) 211	At least once a month (20%) 219	Never or rarely (58%) 219
Frequency with which computer software is used to teach reading	At least once a week (25%) 213	At least once a month (23%) 217	Never or rarely (52%) 219
Frequency with which a variety of books are used to teach reading	Less than weekly (35%) 215	At least once a week (22%) 214	Almost every day (43%) 220
Frequency with which teachers send or take class to library	Never or rarely (5%) 209	At least once a month (9%) 208	At least once a week (85%) 219
Use of multiple choice tests to assess students in reading	At least once a week (14%) 209	At least once a month (49%) 218	Less than monthly (36%) 222
Use of short-answer tests to assess students in reading	At least once a week (34%) 214	At least once a month (44%) 217	Less than monthly (22%) 222
Students write paragraphs about what they have read to assess their reading	Less than monthly (14%) 210	At least once a month (39%) 218	At least once a week (46%) 220
Use of individual or group projects or presentations are used to assess reading	Less than monthly (34%) 212	At least once a month (54%) 220	At least once a week (12%) 220

Source: 1992 NAEP Trial State Assessment
L. Darling-Hammond, National Commission on Teaching and America's Future

Figure 4. Percentage of Public School Teachers with a State License and a Major in their Main Teaching Assignment Field: 1990-91



Source: U.S. Department of Education, Schools and Staffing Survey, 1990-91. Data published in Marilyn M. McMillen, Sharon A. Bobbitt, and Hilda F. Lynch, *Teacher Training, Certification, and Assignment in Public Schools: 1990-91*.

Despite the fact that so many teachers lack the requisite expertise in mathematics, most districts allocate dramatically fewer resources to similar support in mathematics.[16]

As we describe later, variations in teacher qualifications and varying state investments in teacher quality are also related to students' performance on national assessments.

International Comparisons of Teacher Development

Despite the importance of teacher expertise, when compared with countries that might be thought of as peers or competitors, the U.S. invests far less in the preservice and inservice preparation of teachers and allows much greater variability in teachers' access to knowledge. Many European and Asian countries support high-quality teaching by:

- pegging teacher salaries to professions like engineering or civil servants to prevent shortages of qualified teaching personnel;
- fully subsidizing candidates' tuition for a rigorous program of teacher preparation;

Table 2
Results from the Third International Mathematics and Science Study
International Rankings of 8th Grade Students' Performance

Nation	Math Average	Nation	Science Average	Nation	Physics Percent Correct
Singapore	643	Singapore	607	Singapore	69
Korea	607	Czech Republic	574	Japan	67
Japan	605	Japan	571	Korea	65
Hong Kong	588	Korea	565	Czech Republic	60
Belgium-Flemish	565	Hungary	554	Belgium-Flemish	60
Czech Republic	564	England	552	England	62
Slovak Republic	547	Belgium-Flemish	550	Slovak Republic	61
Switzerland	545	Slovak Republic	544	Hungary	60
France	538	Ireland	538	Canada	59
Hungary	537	Russian Federation	538	Hong Kong	58
Russian Federation	535	Sweden	535	New Zealand	58
Canada	527	**United States**	**534**	Switzerland	58
Ireland	527	Canada	531	Russian Federation	57
Iran, Islamic Republic	428	Norway	527	Sweden	57
Sweden	519	New Zealand	525	Norway	57
New Zealand	508	Hong Kong	522	Ireland	56
England	506	Switzerland	522	**United States**	**56**
Norway	503	Spain	517	Spain	55
United States	**500**	France	498	France	54
Latvia (LSS)	493	Iceland	494	Iceland	53
Spain	487	Latvia (LSS)	485	Latvia (LSS)	51
Iceland	487	Portugal	480	Lithuania	51
Lithuania	477	Lithuania	476	Portugal	48
Cyprus	474	Iran, Islamic Republic	470	Iran, Islamic Republic	48
Portugal	454	Cyprus	463	Cyprus	46
International Average	527	International Average	527		

Source: Lois Peake, Pursuing Excellence: A Study of U.S. Eighth Grade Mathematics and Science Teaching, Learning, Curriculum, and Achievement in International Context, National Center for Education Statistics, U.S. Department of Education, 1996.

- encouraging or requiring graduate-level preparation in education, including at least a year-long internship in a school partnered with a university;
- requiring rigorous examinations of subject matter and teaching knowledge before entry into the profession;
- providing beginning teachers with intensive mentoring, support systems, and reduced teaching loads so they can gradually learn to teach proficiently; and
- building extensive time for learning and collective planning into teachers' schedules so they can work together.[17]

Teaching and Teacher Education Abroad

These combined strategies provide systematic supports throughout a teacher's career, with a foundation beginning in preservice education. In Germany, for example, prospective teachers earn the equivalent of academic majors in two disciplines, then pursue two to three more years of rigorous teacher preparation, combining pedagogical seminars with classroom observations and intensively supervised practice teaching. Teacher preparation in Luxembourg is a seven-year process that includes graduate-level professional training. French teacher candidates pursue a two-year program of graduate-level teacher education including an intensively supervised year-long internship in schools, which is similar to the newly-launched, but not yet widespread, professional development schools in the U.S. In Germany, Luxembourg, and France, teachers without full preparation are almost never hired, a practice enabled by subsidies that underwrite teacher preparation and salaries that are competitive with those of other professions. Special supports are typically available once beginning teachers reach the classroom and substantial time exists for ongoing professional learning.

Japan and Chinese Taipei are also moving toward extended teacher preparation programs, including increased study of teaching and learning and intensive internships. In Japan, after graduating from an undergraduate- or graduate-level teacher education program and passing a highly competitive teacher appointment examination, beginning teachers work with a master teacher who observes them on a weekly basis. New Japanese teachers have a reduced load that allows them to observe the classes of other teachers, to participate in seminars and training sessions, and to undertake 60 days of in-school professional development on such topics as classroom management, computer use, teaching strategies, and counseling methods.

Inservice professional development opportunities are extensive in many of these countries. Teachers spend about 20 hours with their students each week and the remaining time working with colleagues on planning and curriculum development, visiting parents, counseling students, pursuing research, and participating in study groups and watching one another teach. Teachers regularly visit other schools, attend teacher-conducted seminars and polish lessons with one another.

These activities are often organized around the state or national curriculum framework, typically a lean instrument outlining a relatively small number of major concepts and ideas to be covered that leaves to teachers the job of figuring out the strategies for doing so in the context of their own school and student body. In China, the curriculum guide provides a common structure that directly supports a kind of professional discourse rarely seen in the United States. Teachers compare notes

about particular lessons and problems, discuss how their students respond to specific tasks, conduct demonstration lessons for one another, and develop plans together.[18]

One finding of the TIMSS studies was that U.S. texts and curriculum guidelines require mathematics and science teachers to cover more topics superficially, and less successfully, than do curriculum guides in other countries, which emphasize in-depth learning about a smaller range of topics.[19] Thus, in these countries where students achieve at high levels, teaching is not only better supported, but it is guided more thoughtfully and adapted more consciously to students' learning needs.

Teacher Development in the U.S.

The United States lacks a professional development system for teachers. Teachers in the United States generally pay for their own preparation and professional development, even though they earn salaries 20 to 25 percent lower than other professionals requiring similar levels of education. These fiscal barriers to preparation for and entry into the profession produce chronic shortages of qualified teachers in some fields and dramatically uneven levels of preparation across the teaching force.

Once they enter the classroom, U.S. teachers have only three to five hours a week in which to prepare their lessons, usually in isolation from their colleagues. Most teachers have no time to work with or observe other teachers; they encounter only occasional workshops that are generally unconnected to their work and immediate problems of practice. This occurs in spite of the enormous staff development industry in this country. Districts, counties, and private entrepreneurs sponsor workshops, institutes, and afterschool meetings to develop, train, refresh, update, and inservice teachers.[20] While administrators form committees, bring in experts, and adopt new textbook series, teachers read *Teaching Mathematics*, *Instructor*, *Learning*, and *American Educator*. Teachers purchase commercial black-line masters for activities, collect books, and enroll in master's degree courses. However, much of this professional education is superficial, unconnected to a coherent vision of teaching or a set of curricular goals, and disjointed across localities and the courses of teachers' careers. Further, access to learning opportunities varies widely across schools and districts, depending on the uneven level of resources available for education and the differing views of school boards about whether and how to spend funds on learning for teachers.

Most teachers in the U.S. have had a relatively thin preservice education program. The majority completed an undergraduate teacher education program that often makes trade-offs between disciplinary preparation and pedagogical preparation (which are generally taught in unconnected courses) and that leaves only a short time for student teaching at the end of a brief training sequence. Some entering teachers now are graduating from redesigned programs that provide more integrated and extended study of content and teaching, but other entrants into the profession, generally those assigned to teach in poor urban or rural schools, receive no teaching preparation at all. Furthermore, many new teachers are assigned to the most disadvantaged schools, where they have the most challenging students and most difficult teaching assignments without receiving mentoring or other support. For all these reasons, about 30 percent of entrants to teaching leave within the first five years. In short, many U.S. teachers enter the profession with inadequate preparation, and few have opportunities to enhance their knowledge and skills over the course of their careers.

It is an oxymoron to call the U.S. teacher education enterprise a system. Its fragmentation and variability account for many of the problems

described above. Three major sources of variability include:

Variability in standards for candidates. There is wide variation in the standards required for entering teaching: licensing standards and their enforcement vary radically from state to state. Some high-standards states require a bachelor's degree in the subject to be taught plus intensive preparation for teaching, including at least 15 weeks of student teaching and preparation for working with special needs students. Some low-standards states require only a handful of education courses, a few weeks of student teaching, little or no preparation in child development or learning theory, and not even an academic minor in the field to be taught. Forty states allow teachers without any preparation who have not met any standards to be hired on temporary or emergency licenses. Some states require performance examinations of teaching knowledge and skills, while others require only tests of basic skills. Some states stringently enforce their standards and refuse to hire unqualified teachers; other states allow districts to hire large numbers of unqualified and underprepared candidates, even when qualified candidates are available.

Variability in standards for programs. Unlike other professions, most states do not require education schools to be professionally accredited, and many state procedures for approving programs are inadequate to ensure quality. The quality of programs in the more than 1,300 institutions preparing teachers ranges from excellent to very poor; fewer than half of colleges meet national professional standards. A growing number of teachers are being prepared in rigorous five- or six-year programs that include intensive internships. However, many future teachers are still prepared in underfunded four-year programs that are treated by their universities as "cash cows," producing greater revenues for training future businessmen, lawyers, and accountants than they spend on the future teachers who are paying this tuition. There is little leverage for the improvement of teacher education programs because states have set up their own approval systems in lieu of professional accreditation, and because most states approve all programs regardless of their quality.

Variability in teacher education curriculum and faculty. What prospective teachers study and where varies widely. Candidates take courses in the arts and sciences and in schools of education. They also spend time in schools. Unlike the curriculum of other professions which has some coherence of substance and pedagogy, the teacher education curriculum is widely distributed but rarely coordinated. Many of those who teach teachers do not think of themselves as teacher educators—English or mathematics faculty, for example—and most have little preparation for the task of educating teachers. They teach their courses as they would to any college student, leaving it to the prospective teacher to integrate subject matter and pedagogical studies. Many faculty members in schools of education do not think of themselves as teacher educators either. Instead, they identify themselves as specialists in sociology, psychology, or reading.[21]

The quality of recently developed alternative certification programs is equally variable. Some are year-long postbaccalaureate models that integrate theory and skills development more productively than some traditional programs. By linking coursework to intensively supervised internships, these programs provide a high-quality preparation to mid-career teaching recruits. Other programs, however, offer only a few weeks of training that ignores fundamental learning theory, child development, and content pedagogy, and places new recruits in classrooms without supervised practice. Finally, few states require or fund the kinds of internships that are provided new entrants into professions such as architecture, psychology, nursing, medicine, or engineering.

Even though they have been quite effective where they exist, structured induction programs are still rare in teaching.

How are Other Countries Able to Support Teaching More Effectively than the U.S.?

The more professional conception of teaching that exists in the European and Asian countries we noted earlier is made possible in part by the standards for teacher education and teaching set by ministries of education or professional bodies established for this purpose. These bodies also establish examinations for entry into the profession. Schools of education and the training of candidates are heavily subsidized by the government in these countries, so that teacher knowledge is not a function of individual ability-to-pay or candidates' preferences about how much they would like to study. Schools of education meet common standards regarding what is taught and learned.

Substantial ongoing professional development is made possible in these European and Asian countries because teachers are the central investment of schools. Funds are used to hire better paid and better educated teachers who make most school decisions and support each other in collegial learning instead of supporting a large bureaucracy to design, monitor, inspect, and augment the work of teachers. Consequently, classroom teachers comprise 60 to 80 percent of education employees in these other countries, as compared to only 43 percent in the U.S., where the number of administrative and nonteaching staff has more than doubled over the last 30 years. (See Figure 5) These other systems provide teachers with greater preparation to help ensure that they make good decisions about curriculum, teaching, and assessment rather than hiring large numbers of supervisors and inspectors to prescribe and oversee their work.

Teaching in these other countries is organized less bureaucratically than in the U.S. Teachers in Germany, Japan, Switzerland, Sweden, and Denmark often serve as counselors, teach multiple subjects, and teach the same students for multiple years, so they come to know their students well academically and personally. Where similar arrangements for personalizing teacher-student relationships have been tried in the U.S., student achievement is significantly higher due to teachers' greater knowledge of their students' learning needs.[22] By hiring more teachers who are better-prepared and better-supported, and by organizing schools around teachers' work with students, the U.S. could reduce the bureaucratic superstructures that currently drain resources from classrooms where they would make a greater difference.

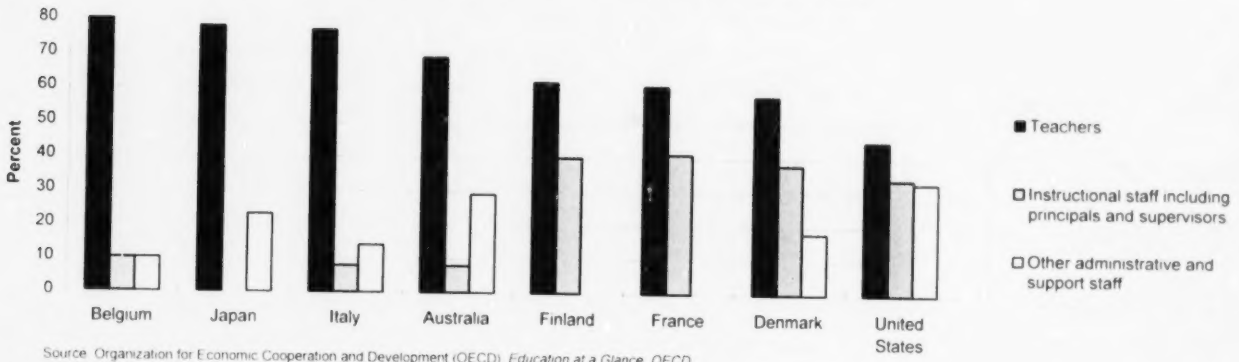
Recommendations of the National Commission on Teaching and America's Future

The National Commission on Teaching has emphasized the critical importance that well-prepared teachers and well-designed schools make in achieving higher standards. The Commission urged states to continue developing student standards "so that high-quality, professionally informed curriculum guidance is widely available to help teachers organize their teaching and build on the work of their predecessors." The Commission noted, "The essential companion to this effort is investment in teacher and school capacities." The Commission offered the following set of interlocking recommendations to ensure a systemic approach to developing high-quality teaching:

Standards for teachers linked to standards for students.

If students are to achieve high standards, we can expect no less from their teachers and other

Figure 5. Comparisons of Educational Staff by Function



Source: Organization for Economic Cooperation and Development (OECD). *Education at a Glance: OECD Indicators* (Paris: OECD, 1995), table p31, pp. 176-177.

educators. To help students succeed in meeting the new standards, the first priority must be reaching agreement on what teachers should know and be able to do. This task has been undertaken by three professional bodies that set standards: for teacher education, the National Council for Accreditation of Teacher Education; for beginning teacher licensing, the Interstate New Teacher Assessment and Support Consortium; and for advanced certification of accomplished veteran teachers, the National Board for Professional Teaching Standards. Their combined efforts to set teaching standards that are linked to new student standards outline a coherent, career-long continuum of teacher development. To advance these standards, the Commission recommends that states:

- Establish professional standards boards.
- Insist on professional accreditation for all schools of education.
- License teachers based on demonstrated performance of their ability to teach to the new standards, including tests of subject matter knowledge, teaching knowledge, and teaching skill.
- Use National Board standards as the benchmark for accomplished teaching.

Reinvent teacher preparation and professional development.

For teachers to have continuous access to the latest knowledge about teaching and learning, the Commission recommends that states, schools, and colleges:

- Organize teacher education and professional development around standards for students and teachers.
- Institute extended, graduate-level teacher preparation programs that provide year-long internships in a professional development school.
- Create and fund mentoring programs for beginning teachers that provide support and assess teaching skills.
- Create stable, high-quality sources of professional development, and allocate one percent of state and local spending to support

them, along with additional matching funds to school districts that invest in teacher learning.

- Embed professional development in teachers' daily work through joint planning, study groups, peer coaching, and research.

Overhaul teacher recruitment, and place qualified teachers in every classroom.

To address teacher recruitment problems, the Commission urged states and districts to:

- Increase the ability of financially disadvantaged districts to pay for qualified teachers and insist that school districts hire only qualified teachers.
- Redesign and streamline district hiring.
- Eliminate barriers to teacher mobility by promoting reciprocal interstate licensing and working with states to develop portable pensions.
- Provide scholarships and forgivable loans to recruit teachers for high-need subjects and locations.
- Develop high-quality pathways to teaching for recent graduates, mid-career changers, and paraprofessionals already in the classroom.

Encourage and reward knowledge and skill.

Schools have few ways of encouraging outstanding teaching or rewarding increases in knowledge and skill. Uncertified entrants are paid the same as those who enter the profession with highly developed skills. Novices assume responsibility for the same kind of work as 30-year veterans. Mediocre teachers receive the same rewards as outstanding ones. And to get promoted, teachers must leave the classroom. To address these issues, the Commission recommends that states and districts:

- Develop a career continuum and compensation systems that reward knowledge and skill.
- Enact incentives for National Board Certification.
- Improve or remove incompetent teachers through peer assistance and review programs that provide necessary supports and due process.

Create schools that are organized for student and teacher success.

In order to focus their energies around a common purpose, schools need to adopt shared learning standards that can guide the efforts of teachers, parents, and the community. Then, schools must be freed of the tyrannies of time and tradition to permit more powerful student and teacher learning. This means restructuring time and staffing so teachers have time to work regularly with one another and with groups of students; rethinking schedules so students and teachers have more extended time together over the course of the day, week, and year; and reducing barriers to the involvement of parents so families and schools can work together. To accomplish this the Commission recommends that states and local boards work to:

- Reallocate resources to invest more in teachers and technology and less in non-teaching personnel.
- Select, prepare, and retain principals who understand teaching and learning and who can lead high-performing schools.

- Restructure time so students have time for more in-depth learning and teachers have time to work with and learn from one another.

Professional Development that Makes a Difference

What do we know about teacher learning that might improve professional development?[23] Recently, renewed attention to teacher education and teacher learning has yielded a growing knowledge base for designing better learning opportunities for teachers. Five premises are especially pertinent to improving teachers' learning opportunities:

- ***Teachers' prior beliefs and experiences affect what they learn.*** Teachers' personal and professional histories have been found to play an important role in what they learn from professional development experiences.

- ***Learning to teach to the new standards takes time and is not easy.*** Teachers' practices do not change merely because they decide to teach differently. There is as much to unlearn as there is to learn, and what there is to learn is complex. Teachers must face their deeply-held notions about learning and knowledge, must reconsider their assumptions about students, and must develop new ways of teaching and assessing their work.

- ***Content knowledge is key to learning how to teach subject matter so that students understand it.*** All the techniques in the world will not, by themselves, help a teacher choose the most productive examples for a classroom presentation. Similarly, listening skills alone are insufficient to help a teacher interpret children's work. In both cases, a teacher's effectiveness depends on what he or she understands about the material at hand, about the discipline, and about children's learning.

- ***Knowledge of children, their ideas, and their ways of thinking is crucial to teaching for understanding.*** Understanding students is essential for making connections. Learning how to hear what students say requires more than acuity: it requires seeing the world through another's eyes and perspective, not an easy task especially when the teacher's and student's worlds are different, sometimes disparate. Knowing how to link students' learning and the curricular goals for which schools are responsible depends on insight into learners—what interests them, what they bring to learning a particular idea or skill, and how they learn.

- ***Opportunities for analysis and reflection are central to learning to teach.*** Teachers need time, space, and encouragement to reflect in ways that facilitate their learning by talking with others, by keeping a journal, or by engaging in action research.[24]

Despite the seemingly obvious nature of these five premises, they are not the foundation for most professional development. A great deal of what teachers encounter as professional development does not consider them as learners, is not designed to help them develop over time, does not focus on the content or students whom they teach, and does not offer opportunity for focused analysis and reflection. Moreover, most professional development is conducted at a distance from the materials and problems of teachers' work. In order to develop their practice, teachers need experience with tasks and ways of thinking that are fundamental to their practice. These experiences must be sufficiently immediate to be compelling and vivid. For teachers to learn more than mere imitation or basic survival, these professional development experiences must also be sufficiently distanced from the teacher's immediate concerns to be subject to careful scrutiny, unpacking, reconstruction, and analysis.

It has become popular to talk of teachers as "lifelong learners," and about teaching as something one learns over time. All teachers accumulate experience, but neither experience nor time alone improves teaching. To highlight the complexity of "learning from experience," Sarason[25] contrasted two 20-year veteran teachers, observing that one teacher had twenty years of experience while the other teacher had one year's experience, twenty times over. What is it that distinguishes learning from and improving one's practice from simply having experience?[26] Teachers need to learn how to operate experimentally in response to unique students and uncertain situations; then they need to be able to use what they learn in those particular cases to inform and improve future teaching. In order to develop their teaching, teachers must see their own learning as essential to practice, and must learn how to inquire systematically into practice. Thus, the best way to improve both teaching and teacher learning is to create the capacity for much better learning about teaching *as a part of teaching*. Professional development would be substantially improved if we were to develop ways to learn and teach about practice *in* practice.

How can teachers learn methods of inquiry that improve their understanding of learning and teaching? One means is to center professional learning in the critical activities of the profession. In medicine and law, to be "in" practice is not necessarily to be in an operating room or a courtroom. One is "in" a realm of legal practice when one drafts or comments on appellate briefs by considering a variety of cases and other sources that bear on the matters in question. Centering teacher education "in practice" means, first, identifying the central activities of teaching practice, and second, selecting or creating materials that usefully depict that work and could be selected, represented, or modified to create learning opportunities for novice and experienced practitioners.

Investigation of practice is another key element in a professional approach to learning. To prepare people to learn in and from their practice, professional education must emphasize questions, investigations, and critiques of teaching and learning. The pedagogy of professional education should be in part a pedagogy of investigation,[27] using tools that permit analysis.

Finally, these elements cannot be adequately cultivated without substantial professional discourse and engagement in communities of practice. Continuous, thoughtful discussion among learners and teachers is an essential element of any serious education because it is the chief vehicle for analysis, criticism, and communication of ideas, practices, and values. Moreover, the discourse of professional education can build collegiality among teachers, and create relations rooted in shared intentions and the challenges of the work. This discourse should focus on deliberation about and development of standards for practice, and on the improvement of teaching and learning.

Below, we discuss four current lines of work that reflect these ideas and hold promise for professional development that can make a difference.

Integrating theory and practice. Beginning teacher education courses and inservice workshops for practicing teachers have traditionally been organized to help educators acquire the knowledge and skill thought to be crucial to teaching. In courses and workshops, educators learn theories and methods of teaching, and in classroom settings, they practice using what they have been taught. The assumption held by university-based instructors and learners and by school-based teachers, field supervisors, and learners is that knowledge is acquired in coursework and applied in practice.[28]

This divide between theory and practice, however, leaves a critical gap unattended. Student teachers are often most influenced by what they observe their cooperating teachers do, or by their own school memories. The effect of teacher education is small when theory is divorced from practice. Although beginning teachers collect ideas, learn about research, and develop some strategies, they have often reported that their professional preparation was of little use or practicality.[29]

Over the past decade, many schools of education and school districts have begun to change these practices. Stimulated by the efforts of the Holmes Group and the National Network for Educational Renewal, more than 300 schools of education have created programs that extend beyond the traditional four-year bachelor's degree program, thus allowing more extensive study of the disciplines to be taught and education coursework that is integrated with more clinical training in schools. Some of these are one- or two-year graduate programs that serve recent graduates or mid-career recruits. Others are five-year models that provide extended preparation for prospective teachers who enter teacher education during their undergraduate years. In either case, the fifth year allows students to devote their energies exclusively to the task of preparing to teach. This enables these programs to provide year-long school-based internships that are woven together with coursework on learning and teaching.

Recent studies have found that graduates of these extended (typically five-year) programs are more satisfied with their preparation, and that their colleagues, principals, and cooperating teachers perceive them as better prepared. Furthermore, these graduates have been found to be as effective with students as more experienced teachers, and they are more likely to enter and stay in teaching than their peers prepared in traditional four-year programs.[30]

Many of these university programs have joined with local school districts to create professional development schools where the clinical preparation of novices can be structured more purposefully. Like teaching hospitals in medicine, the professional development schools aim to be sites for state-of-the-art practice organized to support the training of new professionals, extend the professional development of veteran teachers, and sponsor collaborative research and inquiry. Programs are jointly planned and conducted by university-based and school-based faculty.

Cohorts of beginning teachers receive a richer, more coherent learning experience when they are organized in teams to study and practice with these faculty members and with one another. Senior teachers report that they deepen their knowledge by serving as mentors, adjunct faculty, co-researchers, and teacher leaders. These professional development schools can help create the rub between theory and practice that teachers need in order to learn, while creating more professional roles for teachers and building knowledge in ways that are more useful for practice and ongoing theory-construction.[31] These new programs typically engage prospective teachers in studying research and conducting their own inquiries through cases, action research, and the development of structured portfolios about practice. The programs envision the professional teacher as one who learns from teaching rather than one who has finished learning how to teach, and they envision the job of teacher education as developing the capacity to inquire sensitively and systematically into the nature of learning and the effects of teaching.

Developing professional discourse around problems of practice. An inquiry orientation to knowledge provides a related avenue for improving the quality and impact of professional development. Traditional professional development (such as inservice workshops) and professional forums (such as journals and state

meetings) assume an orientation that concentrates on answers: conveying information, providing ideas, training in skills.[32] With enthusiasm and clever quips, session leaders distribute materials, tips, and guidance. Teachers eagerly collect handouts and reproducible worksheets. In some sessions, participants share ideas, but this is still a discourse of answers, a confident stance of certainty. On one hand, these sessions offer participants an enormous assortment of potential resources, but their potential is restricted by a lack of critical discussion. The common view that "each teacher has to find his or her own style" maintains the individualism and isolation of teaching and impedes teachers' growth. What is needed instead are forums in which teaching and learning can be discussed and analyzed, and where serious examination of practice, its outcomes, and its alternatives is possible.

One forum of this type includes groups or sessions in which teachers look closely at artifacts of practice. The Bay Area Writing Project, now the National Writing Project, is an example of a highly successful and long-standing initiative focused on writing and the teaching of writing. Teachers meet regularly to write, read and discuss one another's writing; examine and talk about children's writing; and develop curriculum and teaching strategies for writing. Over the last decade, at the Education Development Center, Schifter and her colleagues have designed a similar series of projects in which elementary teachers examine students' written work in mathematics. Like the effective curriculum-based workshops reported by Cohen and Hill (see below), Shifter's projects involve teachers in learning mathematics and learning about students' thinking about the same mathematics. Teachers write cases about their students and their efforts to help students learn mathematics, thus developing and discussing their own thinking while creating artifacts useful for others' discussion and learning.[33]

Opportunities for teachers to work directly with artifacts of practice and to develop new forms of professional discourse have emerged as a product of some state and local policy initiatives. In Vermont, a new state assessment system using portfolios of student work became an occasion for teachers to work together. Vermont teachers examine student portfolios, develop guidelines for the construction of such portfolios, and set standards for excellent, acceptable, and weak work. In North Carolina, a high level of professional activity has developed through powerful state networks of mathematics and science teachers and teacher educators. Statewide conferences for teachers and strong professional connections and communications support a context in which individual teachers learn, and in which leaders develop. These leaders, in turn, strengthen the network. As we describe below, such strategies for professional development have been prominent among some states that have experienced recent substantial increases in student achievement.

Content-based professional development. In a recent study of California elementary teachers, Cohen and Hill report that a particular kind of professional development appears to be strongly related to changes in teachers' practices and their students' learning.[34] The researchers based their findings on analyses of a survey they administered to a random sample of California elementary teachers, and on achievement scores of those teachers' students. When teachers had extensive opportunities to learn in "student curriculum workshops" in elementary mathematics, their practice more closely resembled that envisioned by California's new curriculum framework, and their students' achievement on state mathematics assessments was significantly higher.

The "student curriculum workshops" in this study are teacher learning opportunities in which teachers use new student curriculum units on specific concepts in the state's mathematics

framework to investigate mathematics content, instruction, and learning. Within these workshops, leaders in the California Department of Education applied a strategy of "replacement units," which allowed teachers to replace units within their mathematics teaching with specially designed materials for specific curricular areas. Teachers could use the replacement units in place of a textbook's more conventional approach to particular mathematical topics. In some cases, the content of the replacement units was new (for example, discrete mathematics) and in others the units used new approaches to familiar topics, such as multiplication. Teachers studied and used these replacement units and discussed them with their colleagues. Their discussions focused on content as well as on pedagogy and curriculum, and they created an unusual opportunity to learn in teachers' own classrooms and from one another.

The "student curriculum workshops" were strikingly distinguishable from other workshops which had no deep connection to a central topic of a school subject. According to the researchers, the "student curriculum workshops" seemed to offer teachers the opportunity to learn new content and new strategies for teaching it, grounded in the issues and problems of their work. Although much professional development continues to be generic (focusing, for example, on learning styles or classroom management), the researchers' findings suggest that professional development could still be more effective for pedagogical ends if it were grounded in particular content material and in the teaching and learning of specific topics as concrete problems of practice.

These research findings also have implications for the barrage of newly-developed curriculum material that teachers and schools are adopting. Curriculum materials designed for students could offer teachers a concrete context in which to explore content, pedagogy, and learning. For example, the National Science Foundation funded several major mathematics curriculum projects in the last five years, and new textbook series are hitting the market now. These materials—published commercially, aligned with standards for mathematics teaching, and systematically piloted in real classrooms—offer schools new choices of instructional material. Wise planning would include serious consideration of how to use the adoption of innovative materials as an occasion to design and launch teacher study groups or other opportunities for teachers to learn.

Learning from the analysis of practice. The examples in the previous section use a common set of materials drawn from practice as a means of grounding professional discourse. Samples of student work and teacher work are central to the professional development emerging from student and teaching standards, including those of the National Board for Professional Teaching Standards and its analog for beginning teacher licensing, the Interstate New Teacher Assessment and Support Consortium (INTASC). Teachers report that they learn a great deal from analyzing their own and others' practice against standards that reflect accomplished teaching, and from developing a portfolio based on teaching artifacts (videotapes, lesson plans, student work) and reflections on their work.

The INTASC portfolio process is designed to support a performance-based licensing system for beginning teachers. It can also serve as a professional development curriculum for beginning and experienced teachers as well as teacher educators. INTASC offers a model to guide beginning teachers in assembling evidence of their professional work so it can be evaluated by other educators against standards of practice. In Connecticut and other states that have launched such assessments, beginning teachers have experienced mentors who talk with them about their work and about the process of collecting and assembling their portfolios. This creates an opportunity to structure a focused and ongoing discussion of practice. In addition, as experienced

teachers examine the portfolios and talk with one another about this evidence, they discover matters about which they disagree, have different interpretations, or use the same terms to mean different things. These experienced teachers begin to develop some shared standards and common language with which to examine and discuss teaching and learning. Similarly, teacher educators who become involved in assisting beginning teachers to develop their portfolios or in evaluating finished portfolios have unprecedented opportunities to look closely at practice and to discuss it with other educators. These opportunities can be avenues for teacher educators to consider what they are preparing teachers for, and what aspiring teachers need to learn to do.

Among the cornerstones of the National Board and INTASC portfolios are videotaped lessons that are placed in the context of students and curriculum and analyzed. Videotape also offers a concrete context for close study of students, pedagogy, content, and learning in other contexts such as preservice teacher education and ongoing professional development. "Images of reform" are more powerful than abstract discussions of new ideas. Teachers who have never seen children engaged in a mathematics problem or discussing text need opportunities to do so. The videotaped lessons serve, in part, as existence proofs that new forms of practice can happen in schools; they are stepping stones to the development of such practice.[35]

Videotape can be used to frame tasks so that teachers can engage in focused analyses of teaching. Unlike observations of real-time teaching, videotape can be stopped in the middle of an activity or replayed to allow for individual or group thinking, writing or discussion; videotaped activities can be grouped together in different ways for different analytic purposes. Teachers can scrutinize particular moves or statements at various points in the lesson and compare their interpretations or analyses with those of others. Teachers can trace a particular idea in the videotaped class and examine the roles of teacher and students in the development of that idea; they can focus on particular children and see what the children say about their thinking. Studying videotapes can help teachers to develop multiple perspectives and frames of reference with which to interpret information and make conjectures in practice. Such study may also develop teachers' communication skills and capacities by providing a shared context for the analysis of teaching. By talking with others, teachers can develop language and shared referents for communicating more clearly about teaching.[36]

Some university-based teacher education programs are using videotapes and other technology. University of Michigan and Michigan State University faculty have been devising ways to use multimedia records of practice as the basis for study of teaching. These records are taken from third and fifth grade mathematics classes across an entire school year and mounted in a hypertext computer system including videotapes of lessons, children's work, teacher lesson plans, assignments, and reflections.[37] The artifacts provide opportunities for beginning teachers to investigate teaching and learning, to interpret what they see in multiple ways, and to appreciate the context-specific nature of teaching and teacher knowledge. Teacher education students may use the records of practice to study the progress of individual children across a year. They may explore how the culture of the classroom evolved. They may scrutinize the curriculum to uncover what is being taught, to whom, and who is learning what, and how. They can bridge the gap between theory and practice by using technology to bring the classroom to the university.

Promising State Strategies for Improving Teaching

Some states have already begun to take advantage of these more powerful approaches to teacher learning as they add teacher policy to the array of tools used in pursuit of higher student standards. In this section we summarize evidence about what approaches have already made a difference in some states and describe practices that seem likely to do so.

Lessons from Last Decade's Reforms

The critical importance of investment in teaching is demonstrated by state experiences over the past decade. During the late 1980s, a few states undertook major initiatives aimed at improving the quality of teaching. Notable among them for the size and scope of their investments were North Carolina and Connecticut. These states coupled major statewide increases in teacher salaries with intensive recruitment efforts and initiatives to improve preservice teacher education, licensing, beginning teacher mentoring, and ongoing professional development. Since then, North Carolina has posted among the largest student achievement gains of any state in the nation in mathematics and reading. Although North Carolina entered the 1990s near the bottom of the state rankings, it now scores well above the national average in fourth grade reading and mathematics. (See Figures 6, 7, and 8). Connecticut has also posted significant gains and is now one of the top scoring states in the nation in mathematics and reading, despite an increase in student poverty rates during this period.

The North Carolina reforms boosted minimum salaries, launched an aggressive campaign to recruit able students into teacher preparation by subsidizing their college education, required schools of education to become professionally accredited, invested in improving teacher education, created professional development academies and a North Carolina Center for the Advancement of Teaching, developed local sites to support networks like the National Writing Project, launched a beginning teacher mentoring program, and introduced the most wide-ranging set of incentives in the nation for teachers to pursue National Board certification. North Carolina now boasts more Board-certified teachers than any other state. More recently, North Carolina created a state professional standards board for teaching and passed legislation that will create professional development school partnerships for all schools of education. Its Excellent Schools Act of 1997 will develop a more intensive beginning teacher mentoring program, will further upgrade licensing standards, will create incentives for teacher knowledge and skill, and will raise teacher salaries once again.

Connecticut spent over $300 million in 1986 to boost minimum salaries for beginning teachers, and did so in an equalizing fashion that made it possible for low-wealth districts to compete in the market for qualified teachers. This initiative completely eliminated teacher shortages and created teacher surpluses in the state within three years. At the same time, the state raised licensing standards, instituted performance-based licensing examinations, funded a beginning teacher mentoring program, invested in training for mentors, required teachers to earn a master's degree in education for a continuing license, and supported new professional development strategies in universities and school districts. Recently, Connecticut further extended its performance-based licensing system to incorporate the new INTASC standards and portfolio assessments modeled on those of the National Board for Professional Teaching Standards. The state is supporting the creation of professional development schools linked to local universities. Both Connecticut and North Carolina have recently launched performance assessment

systems for students to create better measures of students' higher order thinking and performance skills.

The nation's top-scoring states have long supported high-quality teaching and teacher learning in a variety of ways. Figures 6, 7, and 8 show that Minnesota, North Dakota, Iowa, Wisconsin, and Maine repeatedly rank at the top of the state distribution in student achievement, despite the fact that none has had a statewide curriculum or high-stakes testing system.[38] These states, however, have a long history of professional policy. Minnesota, North Dakota, and Iowa are among the 12 states with state professional standards boards. These three states have enacted high standards for entering teaching and are among the few states that refuse to hire unqualified teachers on substandard licenses. School districts in Minnesota, North Dakota, and Wisconsin are among those most likely to require a college major or minor in the field taught as well as full state certification as a condition of hiring.[39] Minnesota, North Dakota, and Iowa have some of the lowest rates of out-of-field teaching in the country.[40]

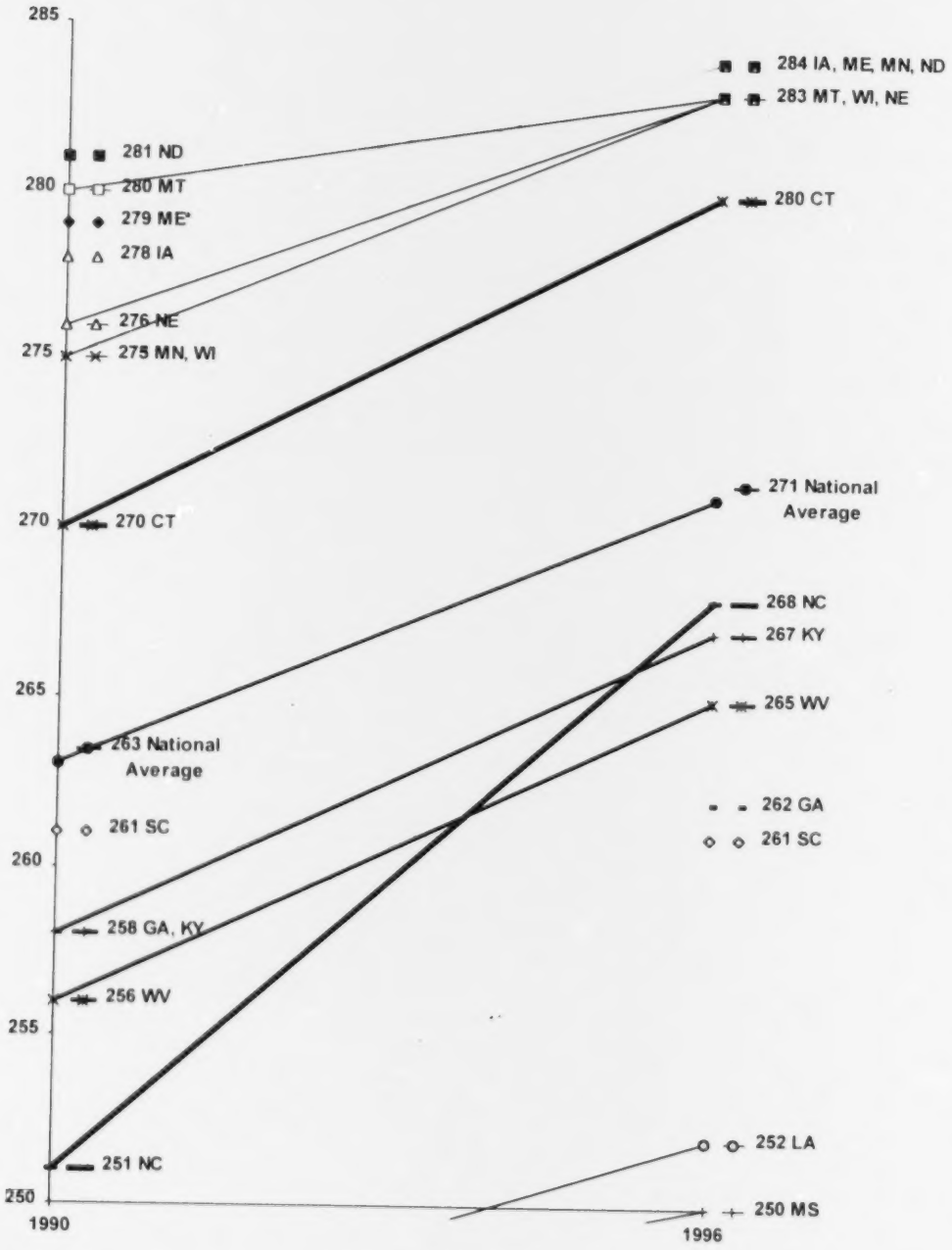
These same states have been leaders in redefining teacher education and licensing. Minnesota was the first state to develop performance-based standards for licensing teachers and for approving schools of education during the mid-1980s, and has since developed a beginning teacher residency program.[41] During the 1980s, Wisconsin was one of the first states to require teachers to earn a major in their subject area in addition to extensive preparation for teaching. As a result, teacher education in Wisconsin is typically a four and one-half to five year process. (This policy contrasts with those of some other states that reduced preparation for teaching when they required students to earn a major in their subject area.) Maine, Wisconsin, Iowa, and Minnesota have all incorporated the INTASC standards into their state licensing standards and have piloted performance-based assessments of teaching within universities.

The National Commission on Teaching and America's Future recognized, as exemplars of leading edge preservice and inservice teacher education, Maine's innovative postbaccalaureate teacher education program at the University of Southern Maine and its Southern Maine Partnership, one of two school-university partnerships supported by the state. Maine also supports regional coalitions of school improvement teams. Both Maine and Iowa have launched state grant programs that allow schools to undertake research-based inquiry and professional development tied to schoolwide efforts to redesign education.

On the other hand, reform strategies that did not make substantial efforts to improve teaching have been much less successful. States that instituted new standards and tests in the 1980s without investing in teaching did not experience improved achievement. The first two states to organize their reforms around a student testing strategy were South Carolina, with its Education Improvement Act of 1984, and Georgia, with its Quality Basic Education Act of 1985. These states developed extensive testing systems attached to high-stakes consequences for students, teachers, and schools. Both states mandated tests for teachers, but did not link these assessments to emerging knowledge about teaching or to new learning standards, nor did they invest in improving schools of education or ongoing professional development. As Figures 6, 7, and 8 show, student achievement in mathematics has been flat in Georgia and South Carolina while reading achievement declined.

In these states, student standards and assessments and increased salaries for teachers could not overcome the effects of large numbers of uncertified teachers and low standards for teacher education, licensing, and hiring. It is also possible that the states' multiple-choice basic-skills testing

Figure 6. Changes in NAEP Scores, Grade 8 Math (1990-1996)



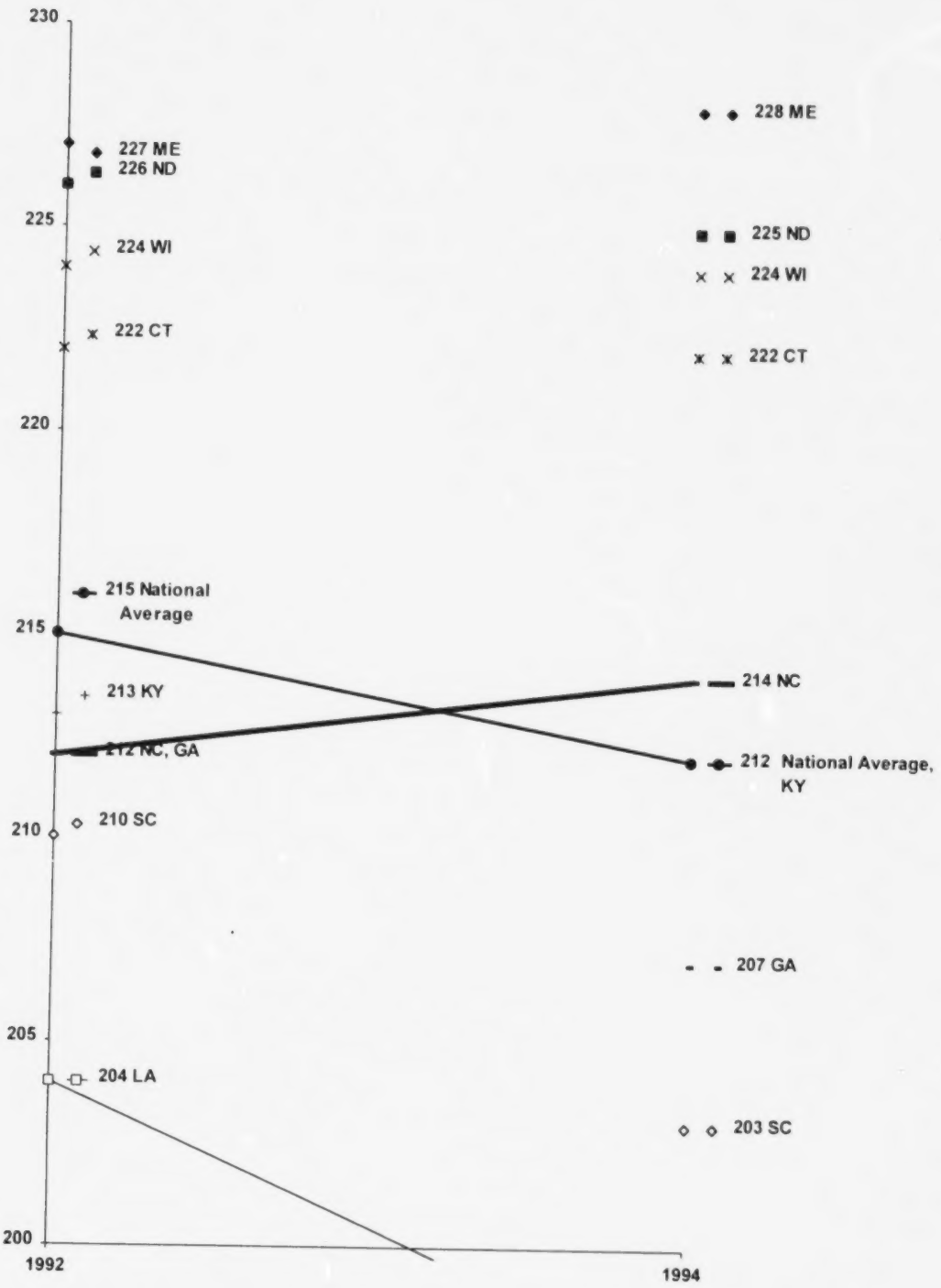
* Note: Maine did not participate in 1990. Score is for 1992 assessment.

Source: National Center for Education Statistics, *NAEP 1996 Mathematics Report Card for the Nation and the States*, Table 2.3, p.30.

Figure 7. Changes in NAEP Scores, Grade 4 Math (1992-1996)

Source: National Center for Education Statistics, *NAEP 1996 Mathematics Report Card for the Nation and the States*, Table 2.2, p. 28.

Figure 8. Changes in NAEP Scores, Grade 4 Reading (1992-1994)



Source: U.S. Department, National Center for Education Statistics. *NAEP 1994 Reading Report Card for the Nation and the States*, Table 2.3, p. 25.

systems worked in opposition to the kinds of student achievement sought by the more performance-based National Assessment of Educational Progress (NAEP), which demands a more sophisticated set of learning and teaching strategies. In fact, as Table 1 shows, frequent use of multiple-choice and short-answer tests in reading is associated with lower rather than higher NAEP scores.

The high-stakes aspects of these reforms may have created or exacerbated other problems as well. Both states' declining graduation rates may have been partly a function of test-based reforms tied to rewards and sanctions. Studies have found that, in many places, test-based sanctions have created incentives for schools to keep out or push out the most educationally needy students: large numbers of students have been retained in grade so that their scores look better, placed in special education so that their scores do not count, denied admission to schools of choice, or pushed out of schools in order to increase average scores.[42] Even though local test scores appear to improve in the short run, these high-stakes strategies have been found to lead to lower student achievement on national measures and to higher dropout rates in the long run.[43]

A somewhat different story characterizes the Kentucky reforms, which included new standards and assessments without high stakes for students. Kentucky's assessments are much more performance-oriented than traditional standardized tests; they were accompanied by school redesign initiatives and massive investment in school spending to equalize funds for poor districts. Kentucky did not initially invest much of its resources in teacher development, but it quickly became apparent that such investment would be necessary for any of the state's ambitious reforms to succeed. Since 1990, Kentucky has created a professional standards board, upgraded teacher education and licensing requirements, and created a variety of new approaches to professional development. By 1994, Kentucky's teachers had more professional development opportunities than teachers in any other state.[44] Kentucky's student achievement in reading declined less than the national average between 1992 and 1994, and mathematics achievement increased more quickly than the national average.

The lessons of reforms to date suggest that states should be encouraged to develop systems that help teachers and principals gain the knowledge they need to teach more effectively and to redesign schools so they can help diverse student populations learn to meet the new standards. States should also develop standards and assessments for students that emphasize authentic forms of learning and that evaluate longitudinal gains in useful ways.

Promising Strategies for the Future

Twelve states have undertaken systemwide efforts to improve teaching and become partners with the National Commission on Teaching and America's Future: Georgia, Illinois, Indiana, Kansas, Kentucky, Maine, Maryland, Missouri, Montana, North Carolina, Ohio, and Oklahoma. These and other states have begun a policy inventory to take stock of the current status of teaching in the state. They have also convened a group of stakeholders who will use this information to develop strategic plans for legislative and programmatic change focused on recruitment, preparation, ongoing professional development, and support of teaching. These states are striving to build policy systems that support teaching to new standards. Several of their promising strategies are described below.

Standards-Based Reforms of Teaching. Almost all of the Commission's 12 partner states are developing systems of standards for teaching. These teaching standards are meant to ensure that teachers have the knowledge and skills needed to

teach children to meet the new student learning standards embodied in recently developed curriculum frameworks. The states are establishing a continuum of standards for teacher development that are aligned with the student standards and with one another; they include the standards set for professional accreditation of education schools through the National Council for Accreditation of Teacher Education (NCATE), for beginning teacher licensing through assessments based on INTASC standards, and for advanced certification of accomplished practice through the National Board for Professional Teaching Standards. States that build this continuum of standards into their policies for approving programs, licensing teachers, and rewarding expert veteran teachers will have the foundation of a professional development *system* that ensures teachers have the knowledge and skills needed to teach diverse learners so they meet high academic standards.

These teaching standards and their accompanying performance-based assessments provide a foundation for rethinking teacher preparation, professional development and incentives for the acquisition of knowledge and skill. In states like Kentucky and North Carolina, where teaching standards are accompanied by policies that equalize districts' abilities to hire qualified teachers and subsidies prepare teachers for high-need fields and locations, the standards provide a means that help for ensuring greater equity in the quality of education available to all children.

Redesign of Teacher Education and Induction. Some Commission partner states—such as Maryland, North Carolina, and Ohio—have been redesigning schools of education to include professional development schools, similar to teaching hospitals, where teachers-in-training learn state-of-the-art practice under the guidance of master teachers and teacher educators. Some states are encouraging schools of education to move toward five-year preparation programs that include a year-long internship at a professional development school. North Carolina, Indiana, and Ohio are implementing new induction programs that provide beginning teachers with more intensive supervision and that include assessments tied to the new teaching standards as the basis for a continuing professional license.

Restructured Professional Development. A number of states are redesigning professional development based on the principles described earlier. Missouri has enacted a two percent set-aside of state and local education funds to be dedicated to professional development. These funds are being used to support regional professional development centers, teacher networks, and study groups. Ohio has created regional teacher academies to extend the work begun by the successful Mayerson Academy in Cincinnati. These academies provide sustained professional development that is supported by new technologies and shaped and managed by district teachers in collaboration with nearby universities. Ohio also operates a successful venture capital fund that underwrites research, inquiry, and professional development by school staff members that is directly linked to their school needs and immediate problems of practice. Maine supports two school-university partnerships and regional school improvement centers that are focused on teacher inquiry, school-based research, teacher study groups, and professional development schools. Content-based professional development networks in California and Vermont have received state support to work with teachers on new curriculum frameworks and assessments.

All of these efforts hold promise for moving beyond generic "hit-and-run" workshops to help teachers meet the challenge of teaching more ambitious content to students who learn in a

variety of ways. Professional development that links theory and practice, that creates discourse around problems of practice, that is content-based and student-centered, and that engages teachers in analysis of teaching can support the serious teacher learning needed to engender powerful student achievement.

End Notes

1. With the advent of new portfolio assessment strategies for assessing the knowledge and skills of beginning and experienced teachers as part of the INTASC (Interstate New Teacher Assessment and Support Commission) and NBPTS (National Board for Professional Teaching Standards), better means exist for probing teachers' knowledge and skills that may produce even greater ability to evaluate expertise and its effects on student learning.

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